**Data format for Merlin Quad System**

**Frame Header**

The frame header is intended to record settings that could change from frame to frame as well as provide enough information to read back the data, even in the absence of the Acquisition Header. The header is represented a text string divided into comma separated fields. The header will also be maintained as a fixed length to ease reading in certain applications.

**Merlin Quad Version 1 Frame Header.**

| Characters (excluding comma) | Data Type | Field Name | Description (MQ1) |
| --- | --- | --- | --- |
| 3 | String | Header ID | Identifies the Frame Header start and allows version identification should any fields change in future. This also allows Merlin Single data headers to be distinguished from Merlin Quad. Quad frames may contain data for one, or many chips.  01B, 04B, 06B, 12B, 24B: Merlin Single Frame;  MQ1: Merlin Quad (version 1). |
|  | U32 | Acquisition Sequence Number | This is the number of a frame within an acquisition sequence. This number will reset with each start acquisition. |
|  | U16 | Data Offset | The offset from the beginning of the header to the beginning of the image data. The same as the total header length. This will also be the offset from the beginning of the file for the first image, or if there is only one per file. |
|  | U8 | Number of Chips | Self explanatory. This may be used with the sensor layout and chip select fields to determine the overall sensor and data configuration. |
|  | U32 | Pixel Dimension X | The image size in the X (width) direction. |
|  | U32 | Pixel Dimension Y | The image size in the Y (height) direction. |
| 3 | String | Pixel Depth | For ease of processing, the pixel size is rounded to a 2^N multiple number of byes. The only exception is single bit mode where eight pixels are packed in a byte. This field represents the pixel depth as a U8 number of bits, with “U” pre-pended.  Valid values include: U01, U08, U16, U32 and U64. |
| 6 | String | Sensor Layout | Text string padded with leading spaces,  2x2, Nx1, 2x2G, Nx1G |
|  | Hex U8 | Chip Select | This is a bit field representation in hexadecimal of the chips that were active during the capture of the frame. Chip 1 is the least significant bit, chip 2, the next bit etc. |
| 26 |  | Time Stamp | Date and time to nearest uS.  Format: yyyy-mm-dd hh:mm:ss.ssssss  Eg 2013-09-17 13:01:53.744951  The time stamp is not intended to be accurate in an absolute sense, but it does give accurate relative timings between frames in the same sequence. |
|  | Double | Acquisition Shutter Time | Floating point representation of the shutter open time in seconds. |
|  | U8 | Counter | Counter 0, or 1. In colour mode, this will represent the colour layer, equivalent to Threshold 0 to 7. |
|  | U8 | Colour Mode |  |
|  | U8 | Gain Mode | 0 = SLGM, 1 = LGM, 2 = HGM, 3 = SHGM. |
|  | Single | Threshold (0..7) | The values of the thresholds in keV. |
|  |  | DACs | One section per chip. |
| n | String | Padding | Null. |

**Merlin Quad Version 1 Frame Header DAC section.**

| Characters (excluding comma) | Data Type | Field Name | Description (MQ1 DACs) |
| --- | --- | --- | --- |
| 3 | String | DAC Format | Medipix 3.0, or RX DAC layout.  MQ1 only supports RX, so only the RX layout is given here.  Current possible values “3RX”, “3.0 |
| 3 | U16 | Threshold 0 | 9 bit DAC. |
| 3 | U16 | Threshold 1 | 9 bit DAC. |
| 3 | U16 | Threshold 2 | 9 bit DAC. |
| 3 | U16 | Threshold 3 | 9 bit DAC. |
| 3 | U16 | Threshold 4 | 9 bit DAC. |
| 3 | U16 | Threshold 5 | 9 bit DAC. |
| 3 | U16 | Threshold 6 | 9 bit DAC. |
| 3 | U16 | Threshold 7 | 9 bit DAC. |
| 3 | U8 | Preamp |  |
| 3 | U8 | Ikrum |  |
| 3 | U8 | Shaper |  |
| 3 | U8 | Disc |  |
| 3 | U8 | Disc LS |  |
| 3 | U8 | Shaper Test |  |
| 3 | U8 | DAC Disc L |  |
| 3 | U8 | DAC Test |  |
| 3 | U8 | DAC DISC H |  |
| 3 | U8 | Delay |  |
| 3 | U8 | TP Buff In |  |
| 3 | U8 | TP Buff Out |  |
| 3 | U8 | RPZ |  |
| 3 | U8 | GND |  |
| 3 | U8 | TP Ref |  |
| 3 | U8 | FBK |  |
| 3 | U8 | Cas |  |
| 3 | U16 | TP Ref A | 9 bit DAC. |
| 3 | U16 | TP Ref B | 9 bit DAC. |

The frame header size will be 256 bytes plus 128 bytes per chip (768 for a typical Quad). All the data is single dimension comma separated, with no extra structure delimiting the DAC blocks. The main block and the DAC blocks are concatenated directly, with all the padding following the end of all the header data.